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EFFECT OF CERTAIN SOLVENTS IN DDT EMULSIONS AND SOLUTIONS ON PLANTS TREATED IN WHITE-FRINGED BEETLE CONTROL

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After DDT was shown to be the most effective insecticide against white-fringed beetles (Graphognathus spp.) (Young 1, 2), studies were undertaken at Long Beach, Miss., and Atmore, Ala., to determine the best methods for applying this insecticide under field conditions. Both soil and foliage treatments were tested and some of these studies are still in progress. This paper deals with the foliage treatments.

Several formulations were tested for applying the DDT spray as a foliage treatment. The insecticide was applied as emulsions and solutions to field crops grown in test plots located in two separate environments. Emulsions were also applied to ornamentals in both test-plot and field plantings. Suspensions were not included, since they are less adhesive and therefore not so desirable as foliage applications for control of adult white-fringed beetles.

EFFECT ON FIELD CROPS

1945 Studies

Tests were initiated in 1945 to study the effect of DDT emulsions and solutions on the foliage and on subsequent crop yield. Applications were made with a concentrated-spray machine (developed by the Bureau) which operated at 3 1/2 miles per hour, covered a swath 25 feet wide, and delivered approximately 6 gallons of spray liquid per acre. The middle rows of each swath received the most drastic treatments, especially when the vegetation was tall, and the observations on foliage injury were made particularly on these rows.

1/ The writers acknowledge the assistance of C. L. Stanford, William Breland, and R. H. Nelson, all of this Bureau; B. P. Livingston, chief, Division of Plant Industry, State of Alabama; Clay Lyle, State entomologist of Mississippi; and personnel of the Alabama State Prison Farm, Atmore, Ala.

Nine emulsion and two solution formulations were tested. The emulsions contained 1 pound of technical-grade DDT, 2 fluid ounces of emulsifier, and the indicated quantity of the following solvents with water to make 6 gallons of spray:

Solvent	Specific gravity	Initial boiling point (°F)	Quarts used
Velsicol AR-50	0.989	444	1
PD 544-B	.990	504	1 1/4
Koppers 44-1842	1.010	388	1
Mentor 25	.951	419	1
Emulsifiable pine oil	.948	192	2 1/2
Amsco-Solv A	.795	200	1 1/4
Xylene	.865	253	1

No emulsifier was added to the emulsifiable pine oil. Triton X-100 was the emulsifier in all other emulsions except that containing Koppers 44-1842, where it was unsatisfactory. Tween 85 was used as the emulsifier with this Koppers solvent. These quantities were used with water to make 6 gallons of spray for the 1-pound-per-acre, and twice these quantities in 6 gallons for the 2-pound-per-acre, applications.

For the solutions 1 pound of DDT was dissolved in enough kerosene to make 10 quarts of solution, or in 1 pint of xylene and enough kerosene to make 10 quarts of solution. These solutions were applied at the rate of 2 1/2 gallons per acre for the 1-pound-per-acre applications. The solutions were also applied at the rate of 1.65 pounds of DDT per acre. For these solutions 1.65 pounds of DDT was dissolved in enough kerosene to make 10 quarts or in 1 quart of xylene and enough kerosene to make 10 quarts. These more concentrated solutions were also applied at the rate of 2 1/2 gallons per acre.

Experimental Design.--One type of experimental design was used at Long Beach and another at Atmore. The Long Beach design consisted of 24 plots 18 by 137 feet, each plot containing the following crops: Sweetpotatoes, peanuts, crowder peas, soybeans, and cotton. The 24 plots were divided into two tiers of 12 plots each, one tier receiving DDT in the different solvents at the rate of 1 pound per acre, and the other receiving DDT at the rate of 2 pounds per acre in the emulsions and 1.65 pounds in the solutions. There was one check plot in each tier.

At Atmore, plots were set up within large-acreage plantings of the various crops tested. A uniform strip of six rows through a given field was selected as the test area. Strips 25 feet long were treated with the various preparations, and there were 50-foot barriers between plots. All formulations were applied at the rate of 1 pound of DDT per acre. The use of this experimental design was made practicable with a specially

constructed auxiliary-tank assembly which could be quickly drained and flushed with only 1 quart of water(fig. 1). After each plot had been treated, the tank and pipe lines were drained and flushed, before the next spray was put into this auxiliary tank. Cotton, crowder peas, sweetpotatoes, and sorghum were the crops tested in these experiments. Peanut and soybean plots located at Goodway, Ala., 17 miles from the prison farm, had the same experimental design and received identical treatments.

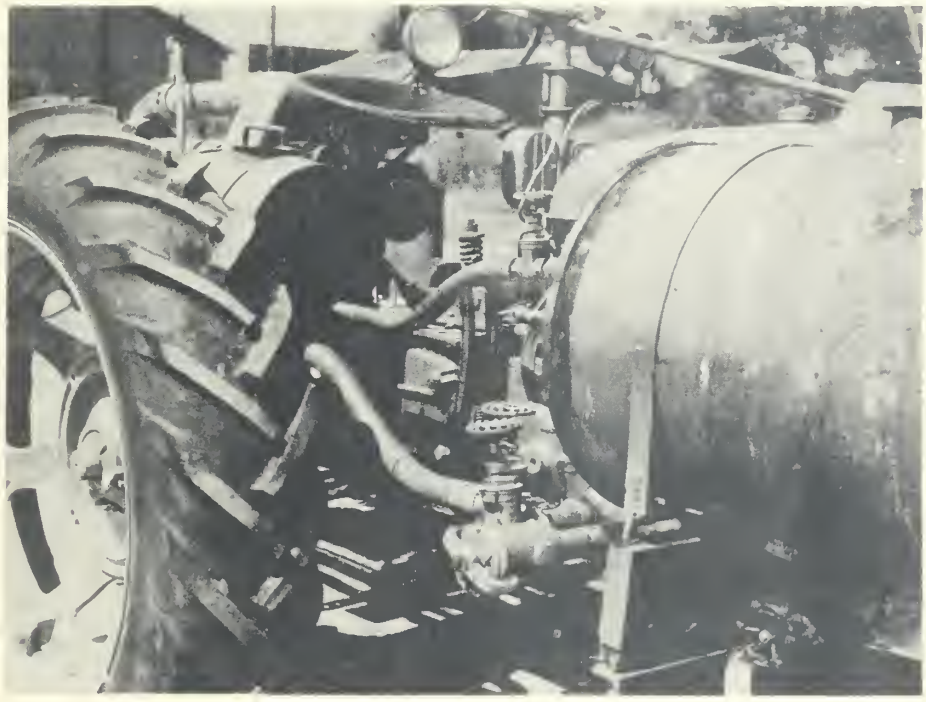

Figure 1.--Auxiliary spray tank mounted on concentrated-spray machine used for applying experimental dosages with regular field equipment.

The amount of injury caused by the different formulations was determined by observing leaf burn at various intervals after each treatment. In order to evaluate the results statistically, the degree of injury was recorded as follows: 0, none; 1, trace; 2, very light; 3, light; 4, medium light; 5, medium; 6, medium heavy; 7, heavy; 8, very heavy; 9, severe; 10, very severe. The degree of injury was not correlated with crop yield. However, a spray causing an injury rating as 4 or higher would probably not be permitted by the farmer for use on his crops.

Long Beach Tests.--The Long Beach plots received four spray applications from August through October 1945. The average degree of foliage injury on the different crops 1 week after each treatment is shown in table 1.

Table 1.--Foliage-injury ratings from DDT emulsion and solution sprays. Long Beach, Miss., 1945

Solvent	Sweet-potatoes		Peanuts		Cotton		Crowder peas		Soybeans		Mean		Mean
	1 lb.	2 lb.	1 lb.	2 lb.	1 lb.	2 lb.	1 lb.	2 lb.	1 lb.	2 lb.	1 lb.	2 lb.	
Emulsions:													
Amsco-Solv A	0	0	0	0	0	0	0	0	0	0	0	0	0
Xylene	0	0	0	1	0	0	0	1	0	1	0	1	.3
Mentor 25	0	0	0	1	0	2	0	2	0	2	0	2	.8
Koppers 44-1842	0	1	1	1	3	1	0	2	1	3	1	2	1.3
Velsicol AR-50	0	1	0	1	0	2	2	2	1	5	1	2	1.4
Pine Oil 1/	0	1	1	3	1	4	1	3	3	4	1	3	2.1
Xylene-kerosene	1	2	1	4	3	6	4	7	3	6	2	5	3.7
PD 544-B	1	3	3	6	3	7	2	5	3	6	2	6	3.9
Kerosene	2	4	2	5	4	6	5	8	5	7	4	6	4.8
Solutions:													
Kerosene	2	2	3	4	5	5	6	6	6	5	4	4	4.3
Xylene-kerosene	2	2	4	4	5	5	6	6	5	6	4	5	4.5
Mean for each dosage	0.7	1.5	1.4	2.7	2.2	3.4	2.4	3.8	2.5	4.1	1.7	3.3	
Mean for combined dosage	1.1		2.1		2.8		3.1		3.3		2.5		

1/ Emulsifiable product purchased locally.

It is evident from table 1 that the spray containing Amsco-Solv A was the least injurious, followed by sprays containing xylene and Mentor 25. There was little difference between Koppers 44-1842, Velsicol AR-50, and emulsifiable pine oil. PD 544-B was unsatisfactory, as were all the emulsions and solutions containing kerosene. Where emulsions were applied, the 2-pound dosage of DDT usually caused about twice as much injury as the 1-pound dosage. However, the solutions did not cause more damage at the higher concentrations. Since twice as much solvent was used for the 2-pound dosage of emulsions as for the 1-pound dosage, but the same amount of solvent was used in both dosages of the kerosene solutions, it is apparent that the greater injury with the 2-pound DDT dosage of emulsions was due to the increased amount of solvent rather than of DDT.

Kerosene was the least satisfactory of all the solvents tested. At the higher dosage, this solvent was unsatisfactory in both emulsions and solutions for all crops except sweetpotatoes, and even sweetpotatoes showed a rating of 4 with the emulsion. The xylene-kerosene emulsion was the least injurious of the kerosene formulations, 1-pound applications giving injury ratings under 4. The other kerosene sprays at the 1-pound dosage gave ratings of 4 or higher in three of the five crops tested.

Sweetpotatoes were the least affected by any of the formulations, and peanuts were second in this respect. The former had an average burn rating of 1.1 and the latter 2.0. The ratings of the other crops fluctuated closely around 3.0.

To determine the effect of the various sprays on crop production, the soybeans, crowder peas, and sweetpotatoes were harvested, and yield records obtained. The results are summarized in table 2. It is evident that there was no significant difference in yield between treated and check plots when four applications of 1 or 2 pounds of DDT per acre were made on these crops. Furthermore, no correlation existed between the degree of foliage injury and crop yield on any of the individual plots.

Table 2. --Average yields (pounds per plot) of crops from DDT-solvent test plots. Long Beach, Miss., 1945

Crop	1-pound dosage		2-pound dosage	
	Treated plots	Check plots	Treated plots	Check plots
Soybean hay	32.7	36.0	40.7	39.0
Crowder peas	8.3	6.3 1/	8.4	6.8 1/
Sweetpotatoes	30.2	33.5	38.2	36.5

1/ Considerable injury from other insects.

In conjunction with the Long Beach studies, analyses were made of the DDT deposits (as determined immediately after application) and residues (as determined before the next application) in the plots treated at the rate of 1 pound of DDT per acre to determine whether or not this insecticide showed differential adhesiveness with the various solvents tested. These analyses were made on 18 cotton leaves (3 from each of the 6 rows) collected immediately before and after the second, third, and fourth treatments. The results are summarized in table 3. The deposits from Amsco-Solv A spray showed the greatest adhesiveness in five analyses and were second in the sixth. This factor was considered in the final selection of the solvent to be used in sprays against white-fringed beetles, but other factors were of greater importance.

Table 3. --DDT deposits and residues (parts per million) on cotton foliage treated with the 1-pound dosage of DDT in various formulations. Long Beach, Miss., 1945

Solvent	Before treatments	After treatments
Emulsions:		
Amsco-Solv A	618	3,437
Emulsifiable pine oil	428	3,186
Velsicol AR-50	796	2,511
Koppers 44-1842	666	2,749
Xylene	618	2,651
Mentor 25	349	2,432
PD 544-B	269	2,261
Kerosene	399	2,061
Xylene-kerosene	399	1,433
Solutions:		
Kerosene	228	1,186
Xylene-kerosene	209	1,107

Atmore-Goodway Tests.--The plots at Atmore and Goodway received five applications at the rate of 1 pound of DDT per acre from August through October 1945. Since they were located at a considerable distance from the headquarters office at Gulfport, Miss., fewer observations were made on the effect of the several treatments. The foliage-injury ratings are shown in table 4.

Amsco-Solv A was the most satisfactory solvent for all crops, closely followed by xylene and emulsifiable pine oil. Kerosene was generally unsatisfactory. Peanuts were least affected by any of the solvents, and sweetpotatoes were next in this respect.

Table 4. --Foliage-injury ratings from DDT emulsion and solution sprays. Atmore and Goodway, Ala., 1945 [1 pound of DDT per acre]

Solvents	Peanuts	Sweet-potatoes	Soybeans	Crowder peas	Cotton	Sorghum	Mean
Emulsions:							
Amsco-Solv A	0	0	0	0	0	1	0.2
Xylene	0	0	0	0	0	2	.3
Emulsifiable pine oil	0	0	0	0	0	2	.3
Mentor 25	0	1	0	0	1	2	.7
Koppers 44-1842	0	1	0	1	1	2	.8
Velsicol AR-50	1	1	1	0	2	2	1.0
PD 544-B	0	2	0	1	3	3	1.5
Xylene-kerosene	0	1	0	2	4	5	2.0
Kerosene	1	2	2	5	1	6	2.8
Solutions							
Xylene-kerosene	1	2	5	5	4	7	4.0
Kerosene	1	4	5	6	4	7	4.5
Mean	.4	1.3	.3	1.8	1.8	3.5	

Yield records taken on three of the crops were as follows (figures in pounds per plot):

	Treated plots	Check plots
Crowder peas	18.9	18.5
Sweetpotatoes	101.4	94.1
Cotton	9.7	9.0

There was no significant difference in yield between the treated and check plots, and no loss could thus be attributed to the use of DDT and/or the various solvents. Squash plants, however, were adversely affected by kerosene sprays. Of 39 plants treated with these formulations, the average spread was 19.8 inches, and they averaged 1.6 blossoms and 1.1 fruits per plant, as compared with a spread of 30 inches, and 4.2 blossoms and 3.6 fruits per plant on 48 plants receiving emulsions containing other solvents.

Selection of DDT Solvent. --The Long Beach and Atmore-Goodway test plots were located approximately 150 miles apart in environments with different soil types and climatic conditions. Moreover, different experimental designs were used. Nevertheless, there was a positive correlation between the results from the two test areas. In both areas Amsco-Solv A was the most satisfactory solvent, followed by xylene at Long Beach and xylene or emulsifiable pine oil at Atmore. Mentor 25 was third in desirability at Long Beach and fourth at Atmore; Koppers 44-1842 fourth at Long Beach and fifth at Atmore, Velsicol AR-50 fifth at Long Beach and sixth at Atmore, xylene-kerosene emulsion seventh at Long Beach and eighth at Atmore; PD 544-B eighth at Long Beach and seventh at Atmore; and kerosene emulsion, xylene-kerosene solution, and kerosene solution in ninth, tenth, and eleventh places, respectively, in both areas. The only major discrepancies in the correlation were the results with emulsifiable pine oil, which held sixth place at Long Beach but tied for second at Atmore. In general, the solvents with lower boiling points caused less damage.

In both areas sweetpotatoes and peanuts were the crops least affected by any of the formulations. At Long Beach sweetpotatoes showed the least injury and peanuts were second in this respect, while at Atmore the order was reversed. There was no adverse effect on the yield of any crops common to both test areas.

In both areas Amsco-Solv A and xylene were the most satisfactory solvents tested. However, one and one-quarter times as much Amsco-Solv A as xylene is required to dissolve an identical amount of DDT, and the cost is 22 percent higher. Xylene may be obtained from many sources, whereas Amsco-Solv A is manufactured by only one company. Furthermore, in large-scale field tests 1-pound dosages of DDT in

formulations containing xylene gave satisfactory results. It was therefore decided to use this solvent in emulsion sprays for applying DDT up to 2 pounds per acre in the 1946 control season and to continue tests with this solvent in emulsion sprays at higher dosages.

1946 Studies

Field Tests.--Field tests were conducted at Atmore, Ala., during 1946 to determine the effect of DDT and/or xylene in emulsion sprays on foliage and subsequent crop yield, when applied as single applications at the rate of 5 or 10 pounds of DDT (5 or 10 quarts of xylene) per acre. Applications were made with the concentrated-spray machine at the rate of 6 gallons of spray per acre. Plots equivalent to 150 feet of row-crop were treated with swaths 25 feet in width. An extra swath was applied on the windward side of each test area to include drift spray as in actual field control. The crops tested when the plants were small (approximately 2 inches above ground) were butter beans, snap beans, cabbage, sugarcane, corn, cotton, cucumbers, lettuce, English peas, field peas, tomatoes, and turnips. Those tested when the plants were large (4 to 6 inches above ground or maturing) were butter beans, snap beans, corn, cotton, onions, and potatoes.

Observations were made 6 days after treatment. The large butter beans, snap beans, cotton, and corn,and the small butter beans and cucumbers showed no burning except on a few leaves where the spray had collected in spots. These crops had an injury rating of 2 and the other crops a rating of 0. When observed approximately 2 months after treatment, all crops that had shown slight burning had completely recovered. It may therefore be concluded that applications of DDT on these crops and under the conditions of these experiments may be safely made up to 10 pounds of DDT (10 quarts of xylene) per acre.

To determine the effect of the 5- or 10-pound dosages on crop production, the snap beans and tomatoes were harvested and yield records taken. The plots treated with 5 pounds of DDT per acre gave slightly higher yields than the untreated checks--18.0 pounds of snap beans and 42.9 pounds of tomatoes as compared with 17.6 and 41.6 pounds from the respective checks. At the 10-pound dosage, however, the yield was slightly lower on the treated plots--18.6 pounds of snap beans and 49.9 pounds of tomatoes as compared with 20.2 and 51.3 on the check plots. At neither dosage, however, were the differences between treated and untreated plots significant.

Control Operations.--In 1946 DDT-xylene emulsion sprays were applied in the course of regular white-fringed beetle control operations in five States. The dosages ranged from 1 to 10 pounds of DDT per acre, and the sprays were applied to both crop and noncrop farm land.

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No burn or other damage was reported by any of the control-area spray supervisors.

1948 Studies

The xylene used in all field tests and control operations in 1945, 1946, and 1947 was a coal-tar derivative. There was a shortage of coal tar xylene in the spring of 1948 while petroleum xylene was readily available. Studies were therefore undertaken to determine whether or not the petroleum derivative would be as satisfactory for our purposes as the coal-tar xylene previously studied. Two series of tests were initiated, one with potted string bean plants and the other with string beans and crowder peas growing in the field.

Potted-Plant Tests. -- A single application was made to 10 potted plants in each test series at the rate of 1, 5, or 10 pounds of DDT (1, 5, or 10 quarts of xylene) per acre. The treatments were applied with a knapsack-type sprayer equipped with a compressed air chamber and a pressure regulator valve (fig. 2). This sprayer was previously calibrated to apply 24 gallons of total spray per acre. Eight coal-tar and two petroleum xylenes were used in this test.

Figure 2. --Knapsack sprayer equipped with compressed air chamber and pressure regulator valve, used in treating test foliage with identical amounts of spray.

Treatments were applied from 6 to 9 a.m. on a cool day in April. Observations made 24 and 48 hours after treatment showed no damage to the bean cotyledons or true leaves from any of the sprays containing the xylenes tested, at the 1-, 5-, and 10-pound dosages employed.

Field Tests.--The field tests were made on beans and peas planted especially for this purpose. The first treatment was applied in May on a hot afternoon, with the same knapsack sprayer used in the potted-plant tests. Observations were made in 48 hours, and the results are shown in table 5.

Table 5.--Foliage-injury ratings from coal-tar and petroleum xylenes and from Ansco A-80 [1/] in DDT-emulsion sprays at different strengths on the cotyledons of beans and peas. Long Beach, Miss., 1948

[1 qt. of xylene with each pound of DDT per acre]

Symbol	String beans			Crowder peas		
	1 lb.	5 lb.	10 lb.	1 lb.	5 lb.	10 lb.
			Coal-tar xylenes			
A [2/]	0	0	0	0	0	2
B	0	0	2	0	0	2
C	0	0	0	0	0	0
D	0	0	1	0	0	4
E	0	1	1	0	1	2
F	0	0	0	0	0	2
			Petroleum xylenes			
G	0	0	2	0	0	7
H	0	0	2	0	0	7
			Amsco A-80			
I	0	0	0	0	0	0

1/ A proprietary solvent.

2/ The xylene of manufacturer A was amber in color. All other coal-tar and petroleum xylenes listed above were water white.

It will be noted from table 5 that none of the coal-tar or petroleum xylenes damaged the cotyledons of beans or peas at the 1- or 5-pound dosages of DDT (except very slight burn on the pea cotyledons at the 5-pound level from the xylene of manufacturer E). At the 10-pound dosage level the coal-tar xylenes were superior to the petroleum products on pea cotyledons. However, pea cotyledons are extremely sensitive, and there was no burn on the true leaves from either the coal-tar or petroleum xylenes at any dosage level. These treatments were repeated on different bean and pea plants on April 16, 1948, but applications were made in the early morning of a cool, cloudy day. Observations made 48 hours later showed no damage to either the bean or pea cotyledons or true foliage from any of the xylenes tested and at any of the dosage levels employed. Since emulsion sprays against adult white-fringed beetles are applied at rates of 1/2 or 1 pound of DDT per acre, xylene derived from either coal-tar or petroleum would be satisfactory for this purpose.

Amsco A-80, a proprietary solvent caused no damage to the cotyledons of beans or peas at any of the dosages tested. In the 1945 tests at Long Beach, Miss., and Atmore, Ala., Amsco-Solv A, another proprietary solvent prepared by the same manufacturer, caused the least amount of foliage burn on the several crops tested.

EFFECT ON ORNAMENTALS

Since white-fringed beetle infestations often occur in or adjacent to nurseries, foliage treatments are applied to ornamentals in these areas. Studies were therefore conducted to determine the effect of DDT-xylene emulsion sprays on this type of vegetation.

1945 Studies

During the summer of 1945 tests were conducted at Perkinston, Miss., to determine the effect of DDT-xylene emulsion applied with the concentrated-spray machine on the foliage of nursery stock. The test area was a tung orchard already divided into 1-acre plots for studying the effect of these sprays on white-fringed beetle populations. One specimen of each ornamental was plunged into the soil around the tung tree centrally located in each plot. The following ornamentals were tested: Azalea indicum (Formosa), boxwood, Camellia japonica (both Professor Sargent and Jeanerette Pink), Camellia sasanqua, Elaeagnus, Gardenia, Oleander,

and Pittosporum (two varieties). The following treatments were applied to the various test plots:

Pounds of DDT per acre	Number of applications	Pounds of DDT per acre	Number of applications
1	7	5	2
			4
			6
2 1/2	4	10	1
	6		3

The dosage of coal-tar xylene in each emulsion was equivalent in quarts to the pounds of DDT.

Applications were made from June to September at intervals of 5 to 20 days. After the last application the plants were removed and placed in pots for further observations. There was no evidence of foliage burn and no indication that bud formation or new growth had been affected by any of the treatments.

1946 Studies

Special Tests. --In 1946 special tests were conducted in flower gardens and city parkways in Gulfport, Miss., to determine the effect of a single application of DDT emulsion on annual and perennial flowers and shrubs. In these tests, which were conducted in May, the emulsion was applied both as a dilute and as a concentrated spray. The dilute spray consisted of 5 pounds of technical DDT, 5 quarts of coal-tar xylene, 7 1/2 ounces of Triton X-100, and water to make 100 gallons of emulsion. The concentrated spray was the same formulation except that sufficient water was added to make 6 gallons of emulsion. In both cases these were the quantities applied per acre.

The plants treated with dilute spray were as follows: Nasturtium, Verbena, Zinnia, Shasta daisy, larkspur, Caladium, sweet pea, stock, snapdragon, Ligustrum, Camellia, Azalea, Pittosporum, Nandina, Spiraea, Hibiscus, Petunia, Calendula, pansy, babysbreath, and St. Augustine grass. Observations made at various intervals up to 1 month after treatment indicated no visible injury to the plant foliage or flowers resulting from the spray applications. In addition, pansy plants received a dosage of 10 pounds of DDT (10 quarts of xylene) per acre with no visible injury.

The plants treated with concentrated spray were Petunia, stock, larkspur, rose, Calendula, Ligustrum, and Abelia. There was no injury from any of these treatments.

Control Operations. --Since foliage burning depends somewhat on the weather, observations were also made in 1946 on ornamentals at four nurseries that had been sprayed with DDT-xylene emulsion during regular control operations against white-fringed beetles. Additional observations on injury were made during the control season, and overall inspections were conducted thereafter.

At New Iberia, La., nursery areas covering 24 acres were treated with both dilute and concentrated spray. A large number of azaleas and camellias were given one 5-pound and five 1-pound applications of dilute (100 gallons per acre) and concentrated (6 gallons per acre) sprays. Among 60 azalea varieties treated with concentrated spray were Pride of Dorking, Macrantha Pink, Duc Derohan, Indica alba, Kinnozai, and several Kurume. The camellia varieties sprayed with concentrated emulsion were as follows:

Missima	Atoma
Rose Emory	Colletti
John Lang	Purity
Napoleon D'Italie	Stardust
Montironi Rosea	Appleblossom

and some very tender 1-year-old grafts of Virgin's Blush and Molly Moore Davis. The following camellia liners received applications of dilute emulsion spray:

Adolph Audusson
Akebono
Alba Plena Imbro.
Althaeiflora
Amazing
Auguste Delfosse
Beni-Korako
Blood of China
Chandleri Elegans
Cheerful
Chiyota Nishiki
Comtesse Nieuport
Conspicua
Cup of Beauty
Daikagura
Debutante (Sara C. Hastie)
Dobrielle
Dr. (Oldwig) Thayer
Ellen McKinsey
Enrico Bettoni
Etiene de Bore
Festiva
Florence Stratton
Florenplena Paeoniflora
Fred Sandler
Gigantea Alba
Gloire de Nantes
(H. A.) Downing
Haku-cho
Haku-rakuten (Sept. Morn)
Hermes
Involutus
Jarvis Red
(Rev.) John Bennett
Julia Drayton
Kagiri
Kasugano
Kishiu-tsukasa
Kiyosu
Kowei
Latifolia
Laurelleaf
Leila
Leucantha
Linda Barry
Lurie's Favorite
Mary E. M.
Mathotiana Rubra (Purpledawn--Wm. S. Hastie)
Mrs. A. M. Hovey
Mrs. (Wm.) Thompson
Nevius
Nobilissima
Oridono-nishiki
Paolina Guichardini
Pink Ball

Pink Perfection
Pink Star
Princessa Bacciochi
Prof. (C. S.) Sargent
Purity
Quartette
Red Gold
Reine des Fleurs
Rogetsu
Roi Leopold
Rosularis
Sarah Frost
Spectabilis
Tenninkwan
Tricolor
Tricolor Special
Wakenoura Rex
White Ball
White Perfection

In addition to these plants, the following ornamentals were sprayed with one 5-pound and five 1-pound applications of the concentrated emulsion:

Bridalwreath
Chinese holly
Mahonia japonica
Ligustrum
Hydrangea
Magnolia grandiflora
Prince Rupert Jasmine
Flowering quince
Cedar
Arborvitae
Juniper
Citrus
Bamboo
Malpighia
Buffordii holly
Xylosma
Hackberry
Spiderlily
Amaryllis
Wistaria
Rose
Boxwood
Palms (several genera)
Ferns (several genera)
Iris
Chinese border grass
Nandina
Pyracantha
Fig
Pear
Yaupon
Podocarpus
Zephyranthes
Pittosporum
Oleander
Pine
Narcissus
Myrtle tree

None of these plants showed any ill effects from the sprays. Special observations were made on Nandina plants, since this ornamental is particularly sensitive. Approximately 25 of these plants were sprayed and no foliage burn or other injury was noted.

At Covington, La., 60 acres of azalea and camellia plants and a large number of Pittosporum plants were sprayed without any injury. The spray schedule was the same as the New Iberia.

At Ocean Springs, Miss., hundreds of camellia (japonica and sasanqua) and azalea plants, and also Japanese holly, Japanese magnolia, juniper, Mimosa, sweet olive, dogwood, Pyracantha, Pittosporum, Japanese quince, Elaeagnus, and boxwood over an area of 5 acres were sprayed once at the 5-pound rate. No injury was observed.

At Mobile, Ala., numerous varieties of camellias were intensively inspected at a nursery covering 2 acres, which had received one application of emulsion at the 10-pound dosage. No injury to the foliage could be attributed to the treatment even though some plants received the full blast of the spray.

These observations substantiate those made in the spring tests at Gulfport--namely, that there was no injury to ornamentals attributable to any of the DDT treatments.

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SUMMARY

During the summer of 1945 DDT emulsion and solution sprays containing different solvents were tested on the foliage of numerous field crops at Long Beach, Miss., and Atmore, Ala. Four applications at dosages of 1 to 2 pounds of DDT per acre were made to determine the most satisfactory solvent for use in white-fringed beetle control. Of eight solvents used, Amsco-Solv A was the most satisfactory, closely followed by xylene. In general, the kerosene formulas, both emulsions and solutions, caused excessive foliage burn. The foliage of sweetpotatoes and peanuts were least affected. None of the sprays, at the dosages employed, affected the yield of snap beans or tomatoes, but there were indications that formulations containing kerosene would adversely affect the yield of squash.

Tests were also conducted in 1945 to determine the effect of DDT-xylene emulsion on the foliage of nursery plants. From one to seven applications were made during the summer with 1 to 10 pounds of DDT (1 to 10 quarts of xylene) per acre-application, or a total of 7 to 30 pounds of DDT (7 to 30 quarts of xylene) per acre-season. There was no evidence of foliage burn or indication that bud formation or new growth had been affected.

In 1946, because of its availability and comparative low cost, xylene was the only solvent used in DDT-emulsion formulations for additional tests and for field control against adult white-fringed beetles. Emulsion sprays were applied at rates up to 10 pounds of DDT (10 quarts of xylene) per acre-season to the foliage of field crops and ornamentals, and the results were entirely satisfactory.

In 1948, tests conducted on potted bean plants and field-grown beans and peas showed that either coal-tar or petroleum xylene is satisfactory for use in white-fringed beetle control.

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